ROYAL GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 4.] APRIL. [1887.

VII.—MANILA HEMP.

(*Musa textilis, Nees.*)

This is one of the most important of cordage fibres, and the whole supply comes from the Phillipine Islands. The imports of Manila hemp to Great Britain amount to about 170,000 bales, and to the United States about 160,000 bales, equal to about 50,000 tons per annum. The fibre is yielded by a member of the banana or plantain family known locally as Abaca (*Musa textilis*), the apparent stem of which is made up of sheathing leaf stalks. The habit of growth and treatment of the plant under cultivation are identical with those so well known in the case of the common banana. The fruit of *Musa textilis* is green and hard and useless as food.

LONDON:
PRINTED FOR HER MAJESTY'S STATIONERY OFFICE,
BY EYRE AND SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

And to be purchased, either directly or through any Bookseller, from
EYRE AND SPOTTISWOODE, EAST HARDING STREET, FLEET STREET, E.C.; or
ADAM AND CHARLES BLACK, NORTH BRIDGE, EDINBURGH; or
HODGES, FIGGIS, & Co., 104, GRAFTON STREET, DUBLIN.

1887.

Price Twopence.

From a report by Consul Honey, dated Manila, 10th April 1879, we gather that this plant thrives best in soils largely composed of decayed vegetable matter. Hence, freshly cleared forest land is essential. Hilly land, about 200 feet to 500 feet elevation, is considered more suitable than low-lying land, probably on account of drainage. The Manila hemp plantations are situated where there is a rich volcanic soil, and where the climate is hot and humid with a heavy rainfall. The plants suffer severely during drought. Although seed is produced plantations are usually established by means of suckers put out when about 3 feet high, and about 8 to 9 feet apart. These form a root-stock, from which numerous stems are successively produced. The land is cleaned of weeds about twice a year. The first crop is reaped at the end of the second year after planting; a full crop is not obtained until the fourth year. The yield is then continued for 15 to 20 years, after which the plantation is exhausted. The stems are fit to be treated for fibre just before they begin to flower. In stems that have been allowed to flower the fibre is said to be weaker and of less value. They are cut about a foot from the ground and the leaves removed. Each stem is then stripped or resolved into its component layers, and these are again divided into strips or ribbons about 3 inches wide. Usually each layer or leaf-sheath is divided into three strips. The outer layers contain a coarser and stronger fibre than the inner, while fibre from near the middle is of a fine silky texture, and capable of being utilised without spinning or weaving and made into articles of dress and ornament.

The method of preparing the fibre is very simple but effective. Each strip, in a fresh succulent condition, is taken up by hand and drawn deftly "between a blunt knife and a hard smooth board," which are attached to a light portable frame. This process, repeated several times if necessary, removes all the watery particles and pulp, and there remains in the hand of the operator a beautifully white and lustrous fibre. The fibre is thoroughly dried in the sun and afterwards packed in bales for shipment. Hemp not properly dried or exposed to rain becomes discoloured and loses strength. On the other hand, hemp from the outer layer of the stem is of a reddish colour, but is quite sound. It is a characteristic of Manila hemp that it readily absorbs moisture, and in an ordinary dry condition it contains 12 per cent. of water. In a damp climate it has been known to contain not less than 40 per cent. of water.

Cordage, ropes, and indeed everything made from Manila hemp can be easily converted into paper of excellent quality.

The cost of establishing a Manila hemp plantation in the Phillipines, including cutting down forest, cleaning and planting, is about 5*l.* to 8*l.* per acre. This does not include the cost of the land. After this the yearly expense of weeding and maintaining the plantation in full bearing is at the rate of 30*s.* to 35*s.* per acre. The yield during the fourth and subsequent years is at the rate of 400 to 700 pounds of dry hemp per acre. "A labourer working under pressure can clean nearly "20 pounds of hemp per diem; but as a rule the quantity cleaned by "one man working steadily, day by day, averages about 12 pounds." Usually two men work together, one cutting down the stems and splitting them while the other cleans the fibre. "At the current "value of hemp in 1879 one labourer's earnings were 7½*d.* to 8*d.* "per diem." Several attempts have been made to introduce machinery, but so far nothing has been so successful as the primitive method above described. It is essential that any machinery introduced should be of a light and portable character, and that it should clean the fibre at a cheap rate, without breaking it.

From these particulars it will be seen that the Manila hemp industry is, to a large extent, supported by special circumstances which happen to be favourably combined in the Phillipines, and hence there is produced an exceptional article in large demand at a comparatively cheap rate. The conditions of soil and climate may possibly be found elsewhere, but as a necessary adjunct to these, there must be an abundant and cheap supply of labour adapted to a rural industry.

A plant of Manila hemp (*Musa textilis*) may be seen in the Palm House at Kew. For the purpose of illustrating the industry there are very complete sets of exhibits in the Kew Museum, No. 2. These include the raw fibre, cables, ropes, twine, fine muslin fabrics, "half stuff," and paper of all kinds, the latter being made from old Manila ropes.

The valuable character of the fibre yielded by *Musa textilis* has naturally drawn attention to it as a valuable industrial plant, and during the last 60 years it has been introduced to India and elsewhere for experimental culture. Plants of *Musa textilis* were cultivated at Calcutta in 1822; specimens were introduced to the Madras Presidency direct from the Phillipines in 1858; while at the Andaman Islands this fibre plant has been thoroughly established.

Experiments in India so far have shown that plants of *Musa textilis* can be successfully grown in many districts; but it is not yet clearly shown that the fibre can be cleaned so expeditiously and so cheaply as to compete successfully with fibre from the Phillipines.

After a systematic series of trials made by the Glenrock Company at Madras in 1885, it is stated that plants put out in 1864 grew well and yielded numerous shoots. 179 stems, weighing about 60 pounds each, were cut down for experimental purposes and passed through Death and Ellwood machines. These produced 159 pounds of clean fibre, or 1·49 per cent. of the green stem. The cost of cleaning the fibre was at the rate of 6*l.* per ton, while the fibre itself, described as "poor, weak, and flaggy, with some clean fibre of good colour," was valued in London at 10*l.* per ton; the best alone was valued at 25*l.* per ton. The minute upon this of the Government of Madras is that "unless much improvement both in the method and cost of production "of this fibre can be made, the cultivation cannot be made remunera-"tive."

Manila hemp plants have been introduced from Kew to Jamaica, and to other portions of the West Indies. In favourable situations they grow well; but not so readily as the ordinary bananas and plantains. As the fruit is valueless they can only be grown for the sake of the fibre and this alone does not appear to offer sufficient inducement to plant up large areas. Usually the return from a fruiting stem of the common banana or plantain would be from 6*d.* to 2*s.*, depending upon the size of the bunch. The return from the Manila hemp plant would according to experience in the Phillipines be about one pound of fibre, the local value of which would be only 2*d.* to 3*d.*

NOTE ADDED.—In the Kew Bulletin, No. 3, pp. 5 and 6, the prices there given for Sisal hemp, as indicated in the context, are not the present prices. The price current in the London market in December 1886 is given on p. 8 of the Bulletin quoted. As showing the average price per ton of Sisal hemp in London for the years 1879–1886 inclusive, we are enabled by the courtesy of Messrs. Ide and Christie, to give the following:—1879, 24*l.*; 1880, 27*l.*; 1881, 28*l.*; 1882, 28*l.*; 1883, 27*l.*; 1884, 21*l.*; 1885, 19*l.*; 1886, 21*l.* The average price for the three months ending March 31st, 1887, is 28*l.* per ton.

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PLANTAIN.

(*Musa sapientum, R. Br.*)

VIII.—PLANTAIN AND BANANA FIBRE.

(*Musa sapientum, R. Br.*)

In connection with Manila hemp some reference may be made to fibres produced by other species of the genus *Musa*. The late Director of the Botanical Department, Jamaica, discusses the subject as follows :—

"It would appear that the fibre of the ordinary plantain and of the banana "is valued at about 12*l.* or 15*l.* per ton. This it will be noticed is only "one-third the value of the best qualities of Manila hemp. There are "in both the East Indies and West Indies numerous wild species of "*Musa* which might yield good fibre, but so far none appears to have "been found equal to the plant yielding Manila hemp. The following "facts have been elicited by recent experiments. A banana stem just "after fruiting, cut as is usual with the country people, about 2 feet "above ground, and denuded of its foliage, weighed 108 pounds; this "being divided into three lengths of 2½ feet each and split longitudi-"nally into several pieces was prepared by beating and washing by "hand, and yielded 25 ounces of clean marketable fibre, which is at "the rate of 1·44 per cent. of the gross weight. The fibre of the "lower portion of the stem, as also the fibre in the petioles of the leaves, "was not extracted.

"A smaller banana, cut under similar circumstances, that is, 2 feet "from the ground, and denuded of its foliage, weighed 41 pounds. "This was divided into two lengths of 2½ feet each, and after being "split longitudinally into several pieces was prepared by hand, and "yielded 6¾ ounces of good clean fibre or at the rate of 1·02 per cent. "on the gross weight.

"At the Hope Plantation similar experiments were conducted with "banana stems which yielded very much the same results. Two "banana stems cut after fruiting, at two feet from the ground, and "denuded of their leaves, weighed 147 pounds. These yielded 33 "ounces of clean fibre, or at the rate of 1·44 per cent. on the gross "weight.

"From ordinary stems of banana, cut after fruiting at about 1½ to "2 feet above ground, a settler might easily prepare about 1½ pounds "of clear fibre, but if the stems are large, and if the whole length is "used as well as the petioles of the leaves, the amount of fibre might "be increased to 2½ pounds if not 3 pounds per stem.

"With plantain stems* the results are more satisfactory than with "the banana, both as regards the yield and the quality of the fibre.

"At the Castleton Gardens, a plantain stem weighing, when cut and "dressed, 25 pounds, was prepared in exactly the same manner as the "banana stems above described and yielded 7¼ ounces of clean fibre or "at the rate of 1·81 per cent. on the gross weight. At the Hope "Plantation a plantain stem weighing exactly the same, viz., 25 pounds, "yielded 9 ounces of clean fibre or at the rate of 2·25 per cent. on the "gross weight. The plantain fibre is whiter and finer than the banana "fibre, and it approaches more nearly to the fine glossy character of "the fibre of the Manila plantain.

"For purposes of comparison I had the fibre of a small stem of the "Manila plantain, which, cut at 6 inches above ground and trimmed,

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* It is to be understood that in these notes the plantain is what is used as a vegetable, while the banana is the soft sweet fruit seen on tables for dessert. In India the name plantain appears to be applied indifferently to both of these.

" weighed 10 pounds, prepared in the same manner as the banana and " plantain fibre, and the result was 3 ounces of a beautifully fine and " glossy fibre. This is at the rate of 1·87 per cent. on the gross weight.

" In Jamaica another plantain is known as the Abyssinian plantain, " *Musa ensete*, which is the largest species of this genus. It was " discovered by the traveller Bruce in Abyssinia, and is remarkable as " being represented on ancient Egyptian sculptures. Specimens of this " plantain growing at the Government Cinchona Plantations at 5,000 " feet have often leaves 20 feet long, the stem is about 8 feet in cir- " cumference at the base, rises to a height of 25 feet and weighs " probably about a quarter of a ton.

" Specimens of fibre prepared from this plantain are of excellent " quality. Taking a portion of the central stem about 4 feet long and " weighing 73 pounds, clean fibre, weighing 13 ounces, was obtained " by beating and washing by hand. This is at the rate of 1·16 per " cent. on the gross weight.

" This plant might be grown extensively for its fibre, and it should " prove valuable, but of course not equal to *M. textilis*, which is un- " approachable as a fibre plant."

It may be mentioned that samples of all the banana and plantain fibres noticed above are to be seen in the Kew Museum, No. 2.

From the same source we find that about 2,000,000 banana stems, after the fruit is gathered, are cut down every year in Jamaica, which are allowed to rot on the land without any attempt being made to utilise the fibre they contain. It is suggested that the merchants who purchase the fruit from the negroes should offer a small sum for clean and well-dried fibre, and take it in small lots as it comes to hand. The merchant might afterwards sort and pack the fibre and put it up in tightly compressed bales for shipment. Some such plan as this, suited to local circumstances, evidently offers the best means of starting a banana-fibre industry in the West Indies.

In the course of the energetic efforts made by Governor Sir William Robinson, K.C.M.G., to develop what are called " minor industries " at Trinidad, attention has naturally been directed to the utilisation of fibre from both the cultivated and wild species of *Musa*.

A " red banana," very commonly cultivated as a shade and fruit plant, and the supply of which is said to be almost inexhaustible, has been brought forward as a possible source of commercial fibre.

A sample of fibre prepared from this red banana was recently sent to Kew, and the opinion of Messrs. Ide and Christie obtained upon it. Their report, dated 29th October 1886, is as follows :—

" We think highly of this fibre, for which we consider there might " be a considerable demand, provided it could be produced of a better " colour. We are inclined to think its dull hue is probably the result " of inexperience in its treatment, either by allowing it to steep too " long in rather foul water or from the leaves being too old and " discoloured before treatment. The attention of preparers should be " directed to the production of a fibre of the bright natural colour of " the enclosed specimen of Manila hemp, and were quantities of the " new fibre produced of this appearance we think they would command " 24*l.* or 25*l.* per ton, to-day, in the London market. Colour is of " great consequence when fibres are used for the production of ' white " hemp ' ropes. Of course in the manufacture of tarred rope colour " is of no moment, but the white ' hemp,' Manila, Sisal, and New " Zealand are seldom tarred."

It is quite possible that, in spite of many years of experimental trial, the fibres of the banana and plantain may not assume great commercial

importance. In that case attention might be turned in another direction, and they might be partly prepared on the spot and utilised for paper-making. But to compete successfully with esparto and wood-pulp the fibre or "half-stuff" of banana and plantain should be delivered in Europe at a cost not exceeding 4*l.* to 6*l.* per ton, depending on condition. For paper-making it might be sufficient to cut the stems into short pieces, and then divide them longitudinally into numerous narrow strips. These, after being passed between rollers to get rid of the water and mucilage, might be dried in the sun, and afterwards put up in compressed bales for shipment.

The whole subject resolves itself into a question of cost, and it can only be practically solved in countries like Demerara, Trinidad, and Jamaica, where several thousand acres are occupied by banana plantations, and where sufficient material lies close at hand to maintain a moderately large industry.

For some years considerable interest has been taken by the Government of Bengal in the subject of the utilisation of plantain stems for the manufacture of paper. In a report presented by Dr. King, Superintendent of the Royal Botanical Gardens, at Calcutta, he mentions:—"Since receiving these papers I have gone into the whole "matter with some care, and I now give you the results. Before "proceeding further, I wish to explain that in the following remarks "the term *plantain fibre* is used to designate the fibres of the various "kinds of plantain found wild and cultivated within the Indian "Empire, but does not include the fibre of the Manila plantain (*Musa* "*textilis*), which is a fibre of an altogether exceptional kind. The "fibre of the Manila plantain, usually known as Manila hemp, is one "of the most valuable fibres known, and is worth in London from "30*l.* to 40*l.* a ton, a price that takes it quite out of the range of raw "materials for paper.

"I have ascertained, by reference to a large English paper-maker, "that if it can be delivered cheap enough, plantain fibre would be "readily bought in England for paper-making. Quotations as to the "exact value of the fibre can hardly be given until a trial shipment "has been put on the home market. Esparto is the fibre against "which plantain fibre would be pitted as a raw material for the paper-"maker, and the price of the best Spanish esparto now (1883) stands "in London at about 10*l.* per ton. It is not likely that plantain fibre "would be so valuable as esparto, but it might bring as much as 7*l.* to "8*l.* per ton."*

It appears that the Bally Mills Company, near Calcutta, has for some time utilised the stem of the cultivated plantain for paper-making, and the results are said to be satisfactory. The company purchase the roughly dried stems from contractors who collect them from villages in the neighbourhood. The price paid by the mill is 3*s.* 6*d.* to 4*s.* per cwt. according to quality. In this instance the preparation of the fibre is very simple. The plantain stem is cut down after fruiting, and the outer sheathing portions are cut into strips and thoroughly dried in the sun. The leaves and central core being useless only about two pounds of rough fibre are obtained from each stem. By this rough mode of preparation the fibre is not freed from the cellular tissue, and although it can be utilised on the spot it is doubtful whether it could be exported in this state.

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* Spanish and Algerian espartos are quoted in London (Dec. 1886) at 70*s.* to 110*s.* per ton. The estimated value of plantain fibre must therefore be reduced to one half of the above.

An attempt was made in the latter part of 1883 to utilise the thousands of acres of wild plantains growing in the Chittagong Hill tracts, which it was thought might yield large quantities of fibre at cheap rates. It was found, however, that any attempt at crushing the stems in a fresh state entailed heavier machinery than could be easily moved from place to place, and the idea was ultimately abandoned without any practical results being achieved. In spite of this, however, Dr. King is of opinion that plantain stems in India will eventually become available as paper material, and considering the immense number grown for shelter, shade, and food purposes, the subject is of considerable importance, both to the people of India and to paper-makers.

IX.—PINE-APPLE FIBRE.

(*Ananas sativa.*)

A note may be added here on the fibre yielded by the leaves of the pine-apple plant. Although not at present in commercial use, this fibre has a future of considerable importance before it. It is finer and stronger than that yielded by any other plant and in the Phillipines, where the West Indian Ananas has become thoroughly naturalized, a beautiful fabric known as "pina cloth" is made from it. A rope of pine-apple fibre $3\frac{1}{4}$ inches in circumference bore a strain, at Calcutta, of 57 cwt.

There are several samples of fibre of a wild pine-apple (*Bromelia sylvestris*, Willd.) from the West Indies and Central America at Kew, but there is no record of their commercial value. A sample supposed to be from this plant was lately sent from Trinidad, upon which the brokers reported as follows:—"Not yet in commercial use, but destined, "we think, to a successful future; fine, soft, supple fibre, strong and "good colour, ample length; say 30*l.* per ton and upwards."

The fibre of the Jamaica pinquin (*Bromelia Pinguin*, L.) would appear not to be of high value. The plant covers hundreds of acres in the plains and lowlands of Jamaica, and an effort was made some time ago to prepare the fibre for commercial purposes. The report of brokers upon a sample of 90 pounds was as follows:—"A long towzelled weak "fibre, of bad colour, coarse, no strength, and only fit for breaking up. "Similar to St. Helena hemp tow, but not so good. We should think "12*l.* to 10*l.* per ton the utmost value." Several samples of this pinguin fibre, from Jamaica and elsewhere, cleaned both by hand and by machine, are to be seen in the Kew Museum, No. 2.

If the leaves of this plant were cut up, roughly dried, and placed in compressed bales, they might prove of value for paper-making. To establish this point it would be necessary to forward to England about half a ton of dried leaves in compressed bales, in order that paper-makers might be able to test them on a sufficiently large scale.

D. M.